

REMARKS

Claims 1 through 3, 6 through 20, 23 through 31, 34 through 37 and 39 through 41 are currently pending in the application.

This amendment is in response to the final Office Action of December 1, 2003.

Claim Objections

Claim 2 is objected to due to informalities in the claim language. Appropriate correction has been made.

Claims 2, 3, 7, 19, 20, 26, 30, 31 and 35 are objected to as lacking proper antecedent basis. Appropriate correction as suggested in the Office Action has been made.

35 U.S.C. § 112 Claim Rejections

Claims 1 through 3, 6 through 20, 23 through 31, 34 through 37 and 39 through 41 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Applicant has amended the claimed invention as suggested by the Examiner for the presently claimed invention to particularly point out and distinctly claim the subject matter of the invention to comply with the provisions of 35 U.S.C. § 112. Therefore, presently amended claims 1 through 3, 6 through 20, 23 through 31, 34 through 37 and 39 through 41 are allowable under the provisions of 35 U.S.C. § 112.

35 U.S.C. § 103(a) Rejections

Obviousness Rejection Based on Ochiai et al. (U.S. Patent 5,643,831) in view of any one of Yeh et al. (U.S. Patent No. 5,607,099), Cordes et al. (U.S. Patent 6,105,852), Tusji et al. (U.S. Patent 5,930,603), MacKay et al. (U.S. Patent 6,293,456) and Fallon et al. (U.S. Patent 5,872,051)

Claims 1 through 3, 6 through 11, 16 through 20, 23 through 31, 34 through 37 and 41 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Ochiai et al. (U.S. Patent 5,643,831) in view of any one of Yeh et al. (U.S. Patent No. 5,607,099), Cordes et al. (U.S. Patent 6,105,852), Tusji et al. (U.S. Patent 5,930,603), MacKay et al. (U.S. Patent 6,293,456)

and Fallon et al. (U.S. Patent No. 5,872,051). Applicant respectfully traverses this rejection, as hereinafter set forth.

Applicant submits that to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the cited prior art reference must teach or suggest all of the claim limitations. Furthermore, the suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure.

Applicant submits that any combination of the cited prior art fails to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 because, in the present instance, the cited prior art contains no suggestion or teaching whatsoever regarding any modification thereof, there can be no showing of any success regarding the modification of the Ochiai et al. reference regarding the claimed or presently claimed invention because any such showing is mere speculation regarding the cited prior art, the cited prior art of record does not teach or suggest all the claim limitations of the presently claimed invention, and any rejection of the presently claimed invention based upon the cited prior art of record would be a hindsight reconstruction of the presently claimed invention base solely upon Applicant's disclosure, not the cited prior art of record because the cited prior art does not contain any suggestion or any modification of the Ochiai et al. reference or combination therewith or teach or suggest all the claim limitations of the presently claimed inventions.

Additionally, with respect to presently amended claims 1, 18 and 29, there is no suggestion or teaching in the Ochiai et al reference to combine the solder ball mold having a specific cavity shape of the Ochiai et al reference with variously-shaped cavities (trapezoidal hemispherical, rectangular and square) asserted to be taught or suggested in the other cited prior art. Further, since there is not teaching or suggestion for any such modification in the cited prior art, the only teaching or suggestion must solely be Applicants' disclosure. In fact, the cavity shape of the mold cavity disclosed in the Ochiai reference is not compatible with cavities that

have trapezoidal, hemispherical, rectangular and square cross sections and clearly teaches away from any combination therewith. The reason for such teaching away is that the Ochiai et al. reference etches a surface having a particular crystallographic orientation (the $\langle 110 \rangle$ plane) which is conducive to the etching of essentially identical wedge-shaped cavities if identical parallelogram-shaped areas of the surface are subjected to etching. Summary of the Invention at Col. 2, lines 62-67; Col. 3, lines 1-20. The wedge-shaped cavity and its associated volume are consequences of the crystallographic orientation of the surface, the parallelogram-shaped exposure areas, and the side dimensions of the parallelogram. Col. 6, lines 63-67; Col. 7, 1-20. The reference suggests or teaches only wedge-shaped cavities. Ochiai et al. does not suggest or teach any other cavity shapes whatsoever. Since the Ochiai et al. reference only forms one specific shape cavity upon exposure to etchants, as well as the relationship of the shape of the exposed surface to the shape of the cavity, it cannot be assumed that cavity shape taught or suggested in the Ochiai et al. reference can be used to fabricate a mold with cavity cross sectional shapes different from the wedge-shape specifically taught by Ochiai et al. reference. In fact, Applicant asserts that one skilled in the art would recognize that because of the crystallographic orientation of the surface used in Ochiai et al. reference, the formation of cavity cross sections in shapes other than wedge-shaped would, in all likelihood, be impossible because the surface is in a crystal plane which affects the cavity shape. Thus, Ochiai et al. reference teaches away from and does not suggest the proposed combination of cited prior art. It should be noted that Figures 14A-14C do not demonstrate cavities with hemispherical cross sections. They are, in fact, only partially formed incomplete wedge-shaped cavities. Col. 7, lines 21-36. They have a basin-shaped profile, i.e., are longer than they are deep. The tendency of the surface to form wedge-shaped cavities prevents the cavities from attaining any hemispherical profile.

Additionally, Applicant's invention is directed to a substrate having a specific cavity shape to transfer solder paste after it has been heated to a semiconductor chip with the solder paste still being a solder paste, not a solder ball or melted solder, so that the shape of the transferred solder paste will form the precise solder ball shape of the bond pad of the semiconductor die. None of the cited prior art teaches or suggests such a concept whatsoever. Additionally, the presently amended independent claims 1, 19, and 29 clearly require a mold to

form the solder paste into two different shapes by the cavity in the mold. The cited prior art taken in any combination does not teach or suggest any such mold. Only the Applicant's disclosure teaches or suggests any such mold and mold cavity.

Since the cited prior art clearly teaches away from any combination thereof, no motivation has been provided why one of ordinary skill in the art would try to combine any of the cited prior art for any reason or reasons. Further, there has been no reasons provided as to why any combination of the cited prior art could be successfully combined as the Ochiai et al. reference will not form any shape but a wedge-shaped cavity. The Ochiai et al. reference must be destroyed for any combination of any teaching or suggestion of any other cited prior art reference therewith. Where in any combination of the cited prior art is there any suggestion or teaching that if the teachings and suggestions of the Ochiai et al. reference are destroyed and ignored, then combined with other cited prior art such a combination will be successful or even result in the presently claimed inventions of presently amended independent claims 1, 18, and 29? Applicant asserts there is no such suggestion or can be no showing of success in the cited prior art because it does not exist therein. Still further, there can be no expectation of success for any proposed combination of the cited prior art. As set forth above, Ochiai et al. reference, at best, suggests or teaches the etching of a specific crystallographic plane in order to obtain wedge shaped cavities. Because of the effect of the crystallographic orientation of the surface plane, any structure of the cavity of the Ochiai et al. reference in combination with any other of the cited prior art is uncertain, if not unlikely to be produced whatsoever in any other type cross sections because of the tying of the cavity shape to one specific crystal plane orientation in the Ochiai et al. reference.

Additionally, there has been no showing of any success for any modification of the Ochiai et al. reference cavity for any combination with the cited prior art. Only assertions have been made without any facts or motivation being presented for any such modifications or combinations. Applicant asserts that no showing of success can be made because the Ochiai et al. reference must be destroyed and cannot create any mold but a mold for a wedge-shaped cavity for any combination with other cited prior art. Applicant asserts that such a combination of the cited prior art cannot and does not establish a *prima facie* case of obviousness regarding the presently claimed invention under 35 U.S.C. § 103.

Accordingly, without any suggestion or teaching in the cited prior art for any combination thereof, without any showing of any success for any combination of the cited prior art since it teaches away from any combination thereof as the Ochiai et al. reference must be destroyed, and without any showing that any combination of the cited prior art teaches or suggests all the claim limitations of the presently claimed invention of claims 1, 18, and 29, the Ochiai et al. reference in combination with the cited prior art cannot and does not establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed invention for the reasons set forth above.

Accordingly, Ochiai et al. reference in combination with any cited prior art does not and cannot *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the claimed invention. Therefore, Applicant respectfully submits that presently amended claims 1, 18 and 29 are allowable for the reasons set forth above regarding the cited prior art failing to *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed invention, and 2, 3, 6 through 11, 16, 17, 19, 20, 23 through 28, 30, 31, 34 through 37 and 41 and 41 are allowable as depending from allowable claims.

Yet further, the Ochiai et al. reference does not teach or suggest all the claim limitations of the presently claimed inventions of amended independent claims 1, 18, and 29 to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the claimed invention. For instance, the Ochiai et al. reference does not teach or suggest or any combination of the cited prior art for the claim limitations of the presently claimed inventions calling for “a substrate having a substantially flat planar surface”, “at least one cavity formed in said surface of said substrate, said cavity having substantially the same dimensions as the at least one metal bump, said at least one cavity having a shape of one of a trapezoidal shape, a hemispherical shape, rectangular shape, and a square shape forming a first shape of the solder paste substantially conforming to the shape of the cavity transferring the solder paste [for transfer] to said secondary substrate substantially in the shape of the at least one cavity and a second shape when reheated during the reflow thereof substantially drawing into a spherical shape held together by the surface tension of the solder material forming an approximately spherically shaped solder ball on a bond pad of said bond pads of said secondary substrate”, and “a release layer applied to said

at least one cavity for minimizing the wetting of solder paste on the substrate during heating thereof from the heating of the substrate”.

At best, the Ochiai et al reference teaches or suggests the formation of a solder ball in a cavity having the shape of a rhombus. Such are not the presently claimed inventions setting forth specific claim limitations in the presently claimed invention not taught or suggested in the prior art. Applicant’s presently claimed inventions do not form a solder ball in the cavity of the substrate such as is taught and suggested by the cited prior art. Applicant’s presently claimed inventions are specifically directed away from any such substrate. While the other prior art references teach or suggest different shaped cavities and a release coating, the Yeh et al. reference transfers a solder ball to a substrate, not solder paste as is claimed, the Mackay et al. reference transfers a molten solder ball to a substrate, not a solder paste as is claimed, the Tsuji et al. reference attaches molten solder to a contact pad of a substrate, not solder paste as is claimed, the Cordes et al. reference uses injected molten liquid solder to form a shape on a substrate to form a solder shape, not solder paste transferred to a substrate as is claimed, and the Fallon et al. reference used molten solder transferred as solder balls to a semiconductor device, not solder paste as is claimed. Absolutely none of the cited prior art references uses a substrate to transfer a specific shape as is claimed of solder paste to a semiconductor die to form a solder ball thereon when heated to a melting temperature. Solely Applicant’s disclosure teaches or suggests such inventions.

Accordingly, Ochiai et al. reference in combination with any cited prior art does not and cannot *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the claimed invention. Therefore, Applicant respectfully submits that claims 1, 18 and 29 are allowable for the reasons set forth above regarding the cited prior art failing to *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the claimed invention, and 2, 3, 6, 7, 16, 17, 19, 20, 23 through 28, 30, 31, 34 through 37 and 41 are allowable as depending from allowable claims.

Applicant submits that any rejection of the presently claimed inventions of presently amended independent claims 1, 18, and 29 on the cited prior art of record would be a hindsight reconstruction of the presently claimed invention based solely upon Applicant’s disclosure not the cited prior art because the cited prior art of record contains no showings, teachings or

suggestions regarding the claim limitations of the presently claimed inventions of amended independent claims 1, 18, and 29. Such a rejection is neither within the ambit nor purview of 35 U.S.C. § 103 and, clearly improper. Such a rejection is a hindsight reconstruction of the presently claimed invention for the reasons set forth above and for the reason that any rejection is merely picking and choosing among features of the cited prior art that contains no teaching or suggestion for their combination or modification as well as not teaching or suggesting the claim limitations of the presently claimed inventions of presently amended independent claims 1, 18, and 29.

Applicant submits that claims 1 through 3, 6, 7, 12 through 20, 23 through 31, 34 through 37 and 39 through 41 are clearly allowable over the cited prior art of record in the application because any combination of the cited prior art fails to establish a *prima facie* case of obviousness regarding the presently claimed invention.

Obviousness Rejection Based on Ochiai et al. (U.S. Patent 5,643,831) in view of any one of Yeh et al. (U.S. Patent 5,607,099), Cordes et al. (U.S. Patent 6,105,852), Tusji et al. (U.S. Patent 5,930,603), MacKay et al. (U.S. Patent 6,293,456), Fallon et al. (U.S. Patent 5,872,051) as applied to claims 1 through 3, 6 through 11, 16 through 20, 23 through 31, 34 through 37 and 41 in paragraph 5 above, and further in view of Bolstad (U.S. Patent 2,979,773)

Claims 12 through 15, 39 and 40 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Ochiai et al. (U.S. Patent 5,643,831) in view of any one of Yeh et al. (U.S. Patent 5,607,099), Cordes et al. (U.S. Patent 6,105,852), Tusji et al. (U.S. Patent 5,930,603), MacKay et al. (U.S. Patent 6,293,456), Fallon et al. (U.S. Patent 5,872,051) as applied to claims 1 through 3, 6 through 11, 16 through 20, 23 through 31, 34 through 37 and 41 in paragraph 5 above, and further in view of Bolstad (U.S. Patent 2,979,773).

Again, Applicant further submits that to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the cited prior art reference must teach or

suggest all of the claim limitations. Furthermore, the suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure.

With respect to the rejection of claims 12 through 15, 39 and 40 under 35 U.S.C. § 103(a) as being unpatentable over Ochiai et al. reference as applied to claims 1 through 3, 6 through 11, 16 through 20, 23 through 31, 34 through 37 and 41 above, and further in view of Bolstad, Applicant respectfully submits that claims 12 through 15, 39 and 40 are allowable in light of the foregoing arguments pertaining to the applicability of Ochiai in combination with any of the cited prior art failing to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the claimed invention. Further, Applicant asserts that Bolstad adds nothing to any combination of the cited prior art to teach or suggest the claim limitations of the presently claimed invention of presently amended independent claims 1, 18, and 29. Applicant further asserts that the Bolstad reference merely illustrates a molding apparatus with no teaching or suggestion as to any combination with the other cited prior art. Applicant asserts that the citation of the Bolstad reference clearly illustrates that any combination of the cited prior art is a hindsight reconstruction of the presently claimed invention by picking and choosing among features in the prior art in attempt to reconstruct the claimed invention. Clearly, the Bolstad reference deals with molding apparatus years before any semiconductor die or device had even been invented. Therefore, the Bolstad reference cannot teach or suggest anything regarding the shape of the cavity in the Ochiai et al. substrate or teach or suggest any other shape cavity, other than a wedge-shaped cavity, could be formed in the Ochiai et al. substrate. Therefore, it can have no teaching or suggestion for any use therewith, other than a hindsight inclusion of a heating strip in the Ochiai et al. reference.

Accordingly, Applicant submits that claims 12 through 15, 39, and 40 are clearly allowable over the cited prior art because any combination of the cited prior art does not and cannot establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed invention for the reasons set forth herein.

Applicant requests entry of this amendment for the following reasons;

The amendment clearly places the application in condition for allowance.

The amendment is timely filed.

The amendment does not require any further search or consideration.

In summary, Applicant asserts that for the reasons set forth herein claims 1 through 3, 6 through 20, 23 through 31, 34 through 37 and 39 through 41 are clearly allowable over any combination of the cited prior art under any rejection based on 35 U.S.C. § 103.

Applicant requests the entry of this amendment, the allowance of claims 1 through 3, 6 through 20, 23 through 31, 34 through 37 and 39 through 41, and the case passed for issue.

Respectfully submitted,



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Date: January 23, 2004

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